MANIPAL UNIVERSITY JAIPUR

School of Electrical, Electronics & Communication Engineering (SEEC)

Department of Electronics & Communication Engineering
Course Hand-out

Digital Communication | EC 1601 | 4 Credits

Session: Jan 15 – June 15 | Faculty: Ms. Madhuri Sahal | Class: Core Course

Course Outcomes: At the end of the course, students will be able to

[EC1601.1] Analyse and compare different analog modulation and demodulation schemes.
[EC1601.2] Evaluate different digital baseband communication methods in time and frequency domain thus developing the analytic skill applicable to digital communication system.
[EC1601.3] Demonstrate different digital passband communication schemes and equip with design skills to apply in communication system.
[EC1601.4] Apply the principles of random signal theory to quantify the information and analyse communication systems.
[EC1601.5] Apply information theory for data compression, transmission and channel encoding, storage and processing.

A. SYLLABUS

Signal detection: Model of digital communication system, Gram-Schmidt orthogonalization procedure, geometric interpretation of signals, response of bank of correlators to the noisy input, detection of known signals in noise, probability of error, correlation receiver, matched filter receiver, detection of signals with unknown phase in noise; Pulse modulation systems: Pulse amplitude modulation (PAM), band width requirements and reconstruction methods, time division multiplexing, pulse duration modulation (PDM), generation of PDM signals and reconstruction methods. Sampling theorem, Analog to digital conversion, quantization and encoding techniques, application to pulse code modulation (PCM), quantization noise in PCM, companding in PCM systems, Time division multiplexing (TDM), examples of PAM and PCM systems, The T1 PCM system in telephony, The delta modulator and its operation, quantization noise and slope overload in delta modulators, Comparison of delta modulation and PCM, Introduction to linear prediction theory with applications in delta modulation; Base band digital data transmission: Base band digital communication systems, multilevel coding using PAM, pulse shaping and band width consideration, inter symbol interference (ISI), Nyquist condition for zero ISI, band-limited Nyquist pulses, the eye diagram, Duobinary and modified duo binary encoding, Optimum detection of a base band data communication systems, Performance limitation of base band data communication due to noise probability of error expression for multi-level data signals; Digital modulation techniques: Band pass (modulated) digital data systems, binary digital modulation, PSK, DPSK, and FSK, M-ary data communication systems, quadrature amplitude modulation (QAM), systems, QPSK, OPSK, and MSK, Introduction to OFDM, Effects of noise in modulated digital communication systems, optimum binary systems, Probability of error expression for binary communications, probability of error in QAM systems, comparison of digital modulation systems, Application of modems for transmission over telephone lines; Information theory and coding: Introduction to information theory, definition of information, examples of simple sources. Information rate and Shannon's coding theory. Shannon's theorem and channel capacity, Block coding for error detection and correction, parity check bits and block coding, Examples of cyclic error correcting codes, Convolution code, tree, trellis and decoding algorithms. Introduction to TCM and turbo coding; Introduction to spread spectrum systems: Direct sequence SSS, Frequency hopping SSS, Application – Ranging multi path CDMA, Spreading sequences.

B. TEXT BOOKS

- S. Haykin "Digital Communications" John Wiley and Sons.
- H. Taub & D.L. Schilling "Principles of Communication systems", McGraw-Hill Co.
- H.P. Hsu "Analog and Digital Communications", Schaum's outline series.
- J. G. Proakis "Digital communications" McGraw-Hill, 2009.